

WHITE PAPER

Intel Announces Xeon Processor with 64-Bit Extensions

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Executive Summary

Intel will ship the Xeon processor with 64-bit extensions in mid-2004. In addition to offering full native 32-bit performance, expanded on-chip cache capacity, new 64-bit extension technology instructions, new power management features, and a faster front-side bus, this new Xeon processor will also extend the virtual address space for the Xeon family of processors from 32 to 64 bits. Thus, Intel will offer two 64-bit processor product lines: Xeon processors with 64-bit extensions and Itanium processors.

IDC believes that these two product lines will be differentiated and will coexist in the marketplace. While the processors both support a 64-bit address space, they differ in other areas and will be used to support different workloads.

Xeon Versus Itanium Processors: Three Key Differences

- ☒ Intel Xeon processors with 64-bit extensions will provide full native 32-bit performance for the large number of 32-bit applications while allowing code that is recompiled for 64-bit processing to access more memory. Intel Itanium processors not only provide a larger address space but also bring larger caches and new performance-enhancing technologies, such as the EPIC architecture, to market.
- ☒ Integer processing performance is approximately equal for Xeon processors with 64-bit extensions and Itanium processors, while floating-point processing is significantly faster on Itanium processors. Transaction and enterprise application performance is also faster on Itanium processors than on Xeon processors. These performance differences mean that Itanium processors are better suited for database and high-end enterprise applications and for many scientific and analytic applications.
- ☒ Xeon processors with 64-bit extensions and Itanium processors are both engineered with on-chip reliability and scalability enablers, including memory spares, chipkill memory, and error correction codes (ECC). The Itanium processor family employs additional on-chip reliability techniques, such as the ability to contain bad data, which favor its use for mission-critical applications. In addition, Itanium processors are more scalable than Xeon processors with 64-bit extensions due to the EPIC architecture, larger caches, and higher bus bandwidth.

Xeon Versus Itanium Processors: Workload Analysis

IT planners should weigh the relative strengths of Xeon with 64-bit extensions and Itanium processors when making deployment decisions. Key differences in performance, scalability, and reliability lead to different optimal workloads for workstations and servers based on the two processor implementations.

- ☒ The Xeon processor with 64-bit extensions is best suited for infrastructure, workgroup, workstation, Web, and IA-32 applications in the datacenter. With full-performance IA-32 compatibility and 64-bit address space combined with Moore's law-based improvements in performance, Intel's new Xeon processor will handle the increasing requirements for these enterprise workloads.
- ☒ The Itanium processor is best suited for enterprise-scale database and transaction processing workloads and for technical computing applications. With its EPIC architecture, larger caches, higher bus bandwidth, and greater scalability, the Itanium processor will often be deployed in large symmetric multiprocessor (SMP) servers to provide greater performance for these workloads than the new Xeon processor. Scaling advantages for SMP servers using the Itanium processor versus the new Xeon processor increase sharply when moving to 8-way and higher SMP configurations.

Both Intel processors offer industry-standard architectures that are well supported by system suppliers and software vendors. The new Xeon processor will initially support 64-bit Linux operating environments; support for the 64-bit Microsoft Windows operating system is expected later in 2004. The Itanium processor already supports 64-bit Windows, Linux, and Unix operating systems. Scale-out deployment of multiple servers configured as clusters or grids of pooled computing resources will be common — an emerging architecture that IDC calls the *utility computing model*.

64-Bit Processing Defined

A processor with a 64-bit virtual address space allows programs to directly access 16 exabytes of memory, a massive increase from the 4GB of memory addressed by 32-bit processors. Although 4GB is a substantial amount of data, some of today's business applications address even larger data sets. For example, enterprise resource planning (ERP) and data mining (i.e., large database analysis) applications often exceed the 4GB limit. In these cases, a 32-bit processor will require additional clock cycles and cumbersome programming techniques to access memory beyond 4GB, thus negatively affecting performance.

A 64-bit address space does not inherently improve a processor's performance. For applications requiring less memory, performance will not increase when moving from a 32-bit processor to a 64-bit processor with the same instruction set. Web serving and file/print workloads do not require extensive addressable memory. Similarly, when a 32-bit application is moved to a 64-bit processor, then memory access is still limited to 4GB and performance may not improve. Recompilation will be required. After recompilation to run in a 64-bit environment, the application will be able to access significantly more memory, but performance will not inherently be improved.

The Intel Architecture Ecosystem

Customers who integrate servers and workstations with Xeon processors with 64-bit extensions and Itanium processors will avail themselves not only of Intel's processor technology but also of a large ecosystem of product and service providers. Major system suppliers worldwide will ship servers with both processors, software suppliers will port to both server systems, and integrators will deploy these systems.

The process takes time, however; software suppliers typically spend up to a year porting (i.e., migrating, optimizing, and certifying) versions of their products for new processors after hardware is available in the marketplace. IDC believes that the ecosystem for Xeon processors with 64-bit extensions will mature in 2005.

Intel expects system suppliers to draw from the Itanium processor family when building large SMP servers and mission-critical, highly-available systems. Volume platforms and high-performance workstations will primarily use the Xeon processor with 64-bit extensions.

Intel's Challenges

One major challenge for Intel will be to clearly communicate which workloads are best supported by each of its product lines. IDC believes that sharp differentiation may not hold for some workloads. That is, some workloads may thrive when using either processor family.

IDC has forecast significant consolidation among manufacturers of processors and has argued that, at the system level, this consolidation would neither reduce consumers' choice nor increase price. Our forecasts remain in force. The message for consumers is that, at the system level, choices are expanding. The challenge for Intel is to compete as a component provider in a market that is increasingly competitive and filled with new processor offerings.

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